

## Lightweight Magnetic Cooler with a Reversible Circulator, Phase I

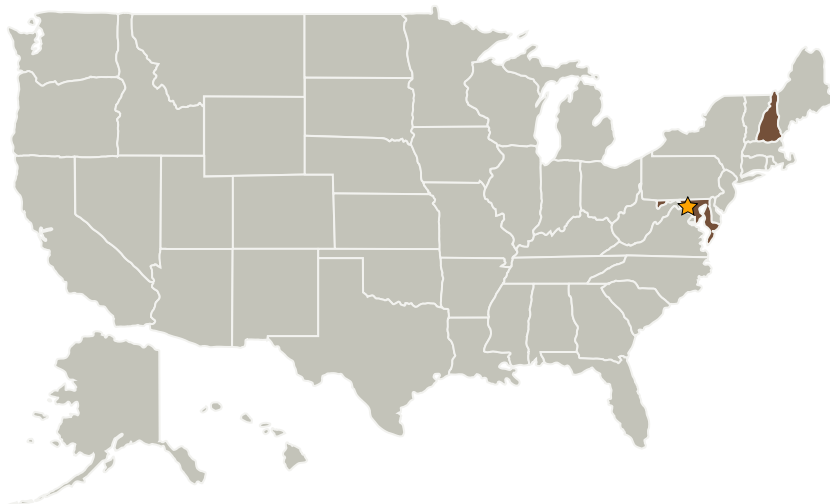
Completed Technology Project (2007 - 2007)



## Project Introduction

NASA's future missions to investigate the structure and evolution of the universe require highly-efficient, very low temperature coolers for low-noise detector systems. We propose to develop a highly-efficient, lightweight, space magnetic cooler that can continuously provide remote/distributed cooling at temperatures in the range of 1 K with a heat sink at about 30 K. The proposed magnetic cooler uses an innovative cryogenic circulator that enables a lightweight magnetic cooler to achieve a large cooling capacity over a large temperature span. The circulator also enables the magnetic cooler to provide remote/distributed cooling and reduces the mass of the magnetic shields. The circulator has heritage in Creare's space-proven micro-turbomachine technology which has demonstrated long-life (>10 years) with no-discernable emitted vibrations. The proposed system will be much lighter than current multistage magnetic coolers. In Phase I, we will prove the feasibility of the magnetic cooler by producing designs for the magnetic cooler and the circulator that will demonstrate the mass and performance benefits of the approach. A magnetic cooler design will be delivered to NASA for future mission studies at the end of Phase I. In Phase II, we will design, build, and demonstrate the operation of a complete prototype circulator that will be delivered to NASA for integration into a magnetic cooler.

## Primary U.S. Work Locations and Key Partners



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with a Reversible Circulator,  
Phase I

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Organizational  
Responsibility**Responsible Mission  
Directorate:**

Space Technology Mission  
Directorate (STMD)

**Lead Center / Facility:**

Goddard Space Flight Center  
(GSFC)

**Responsible Program:**

Small Business Innovation  
Research/Small Business Tech  
Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
Maryland	New Hampshire

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors